

REMARKS

Claims 1-61 are pending in this application.

Claims 1-61 are rejected.

In the amended list of claims, claims 2-10, 12-17, 24-25, 41, 44, and 47 are canceled.

Claim rejections under 35 USC § 112

Claims 2, 5-9, 41, 44, and 47 are rejected under 35 USC § 112, second paragraph. In compliance with the rejection, claims 2, 5-9, 41, 44, and 47 are canceled.

Claim rejections under 35 USC § 103(a)

Claims 1, 2, 4, 6, 8, 13, 17, 18, 20-40, 42, 43, and 50-60 are rejected under 35 USC § 103(a) as being unpatentable over Piccoli et al. and in view of Wismann et al.

Claims 2, 4, 6, 8, 13, 17, 24, and 25 are canceled, as indicated above, mooted the rejections over Piccoli in view of Wismann.

Applicant respectfully requests allowance of claims 1, 11, 18-23, 26-40, 42-43, 45-46, and 48-61 for the reasons presented below.

Claim 1 is amended to address the Examiner's concern with respect to the prior art of Piccoli et al. and Wismann et al.

Piccoli teaches removal of impurities by adsorption alone without any oxidation using a sorbent. There is no oxidation step. Wismann teaches specifically only the removal of odor causing mercaptans by oxidation and adsorption.

Claim 1 is amended to recite a method of removing thiophenes and their higher homologs, and heteroatom compounds involving nitrogen and oxygen, by flowing a mixture of liquid hydrocarbons and an oxidant to carry out the oxidation of the impurities over a particulate catalyst impregnated sorbent and its simultaneous adsorption on to

the particulate catalyst impregnated sorbent, narrowing the claim. Claim 1 also recites the temperature window of operation of the method.

The process of Wismann is concerned only with removal of odor causing mercaptans. Mercaptan compounds consist of a sulfur atom attached to a hydrogen atom and to only one carbon atom. The mercaptans are oxidized to sulfides that are non-odorous. On the other hand, amended Claim 1 teaches the oxidation of thiophenes and their higher homologs to oxidized compounds and their adsorption on a particulate catalyst impregnated sorbent.

Claims 3, 9, 19, 45-47 are rejected under 35 USC 103(a) as being unpatentable over Picolli in view of Wismann and further in view of Fleck. Claims 5, 7, 10, and 11 are rejected under 35 USC 103(a) as being unpatentable over Picolli in view of Wismann and further in view of Valyocsik. Claims 12, 16, and 41 are rejected under 35 USC 103(a) as being unpatentable over Picolli in view of Wismann and further in view of Carnell. Claim 44 is rejected under 35 USC 103(a) as being unpatentable over Picolli in view of Wismann and further in view of Dolian et al. Claims 48 and 49 are rejected under 35 USC 103(a) as being unpatentable over Picolli in view of Wismann and further in view of Stowe.

The rejection of claims 3, 5, 7, 9, 10, 12, 16, 41, 44 and 47 are mooted by cancellation. Applicant respectfully submits that the further prior art cited by the examiner are no longer relevant based on the canceled claims and the newly amended claims.

Thiophenes and their higher homologs inherently are significantly different from mercaptans because the sulfur atom in the former are attached to not one but two carbon atoms forming a much more hindered structure than mercaptans. Following oxidation in the claimed method, the oxidized thiophene sulfur compound (typically sulfone or sulfoxide) which is highly polar, is much more selectively adsorbed with respect to other hydrocarbons by the particulate catalyst impregnated sorbent. In

experimental work using the methods claimed, Applicant has removed sulfur from a high sulfur diesel containing as much as 8000 ppmw of sulfur to below 26 ppmw, continuously running the process with interim washing with a polar solvent in excess of 5 months without significant degradation of the particulate catalyst impregnated sorbent. The adsorbed oxidized thiophene sulfur compound is also much more easily removed due to its high polarity by washing with a polar solvent to affect the rejuvenation of the particulate catalyst impregnated sorbent. Thus the claimed method is significantly more selective and efficient than a method that uses only adsorption as described by Picolli.

Therefore, Applicant respectfully submits that it would not be obvious from the combined teachings of Wismann and Picolli to a person skilled in the art to use oxidation and adsorption to remove thiophenes and their higher homologs, and heteroatom compounds involving nitrogen and oxygen.

The cited further references (i.e., Fleck, Valyocsik, Carnell, Dolian, and Stowe) fail to cure the deficiencies of Picolli and Wismann with respect to claim 1, from which all the remaining claims depend.

CONCLUSION

In view of the above, Applicant respectfully requests reconsideration and withdrawal of all rejections, and a timely notice of allowance of claims 1, 11, 18-23, 26-40, 42-43, 45-46 and 48-61.

Should the Examiner have any questions, the Examiner is invited to contact the undersigned at the telephone number listed below.

Payment for the requested extension of time is made by credit card with this submission. The Director is authorized to charge any additional fee(s) or any underpayment of fee(s), or to credit any overpayments to Deposit Account **50-0337**. Please ensure that Attorney Docket No. 7340-103/10615238 is referred to when charging any payments or credits for this case.

Respectfully submitted,

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